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BUSHING FOR TELESCOPING STEERING COLUMN ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The subject invention relates to a vehicle steering column of the kind having jackets of the column engaged one within the other in a telescoping fashion to adjust a height position of a steering wheel connected to the vehicle steering column to accommodate the position of a driver.

2. Description of the Prior Art

[0002] Generally, a variety of tilting and telescoping steering column arrangements have been developed and are used today in the field of automotive industry. A telescoping steering column assembly typically uses two jackets, wherein one jacket is fixed to a frame of a vehicle body, and the other jacket is adapted to be translated with respect to the jacket fixed to the frame, thereby providing relative longitudinal movement between the two jackets with respect to one another. These jackets, engaged one within another in a telescoping fashion, allow the driver to push or pull the steering wheel to a desired position and then to lock the telescoping column. Three fundamental conditions are required by the telescoping adjustment: the telescoping steering column must have a low adjustment force, the jackets must lock securely, and the stiffness of the telescoping steering column must not be degraded.

[0003] Various configurations and designs are available in the prior art for adjusting telescoping steering column assemblies and have been disclosed in United States Patent No's. 4,796,481 to Nolte, 5,287,763 to Nagashima, 5,520,416 to Singer, III et al., 5,921,577 to Weiss et al., 6,036,228 to Olgren et al., 6,216,552 to Friedewald et al., 6,364,357 to Jurik et al., 6,450,532 to Ryne et al., 6,540,618 to Mac Donald et al., and 6,543,807 to Fujiu et al. To provide the low adjustment force and high stiffness, the prior art designs include a sleeve bushing disposed between the jackets disposed one within the other in the telescoping fashion with a low coefficient of friction and a very close fit to the ID, i.e inner diameter, and OD, i.e. outer diameter, of the jackets. These

two requirements are sometimes at odds, because the close fit may increase the adjustment force.

[0004] Although the prior art configurations of the telescoping steering column assembly are used in the automotive industry today, there remains an opportunity for a new design for adjusting the relative longitudinal position between two jackets of a steering column and for a telescoping sleeve that optimizes the performance in both areas.

BRIEF SUMMARY OF INVENTION

[0005] A telescoping steering column assembly of the present invention includes a lower mounting mechanism for connecting to a body, a lower jacket having inner and outer surfaces connected to the lower mounting mechanism, an upper jacket having inner and outer surfaces and disposed in telescoping relationship with the lower jacket, and an upper mounting mechanism for connecting to the body for slidably supporting the upper jacket for telescoping movement relative to the lower jacket between various positions. The telescoping steering column assembly includes a linear bushing having leading and trailing ends and sidewall disposed between the inner surface of the upper jacket and the outer surface of the lower jacket. The linear bushing includes a plurality of convolutions disposed axially in side-by-side relationship as viewed in cross-section and extending between the ends of the bushing to provide outer load bearing surfaces to engage the inner surface of the upper jacket and to provide inner load bearing surfaces to engage the outer surface of the lower jacket and to provide radial walls for flexing to maintain the bearing surfaces in engagement with the jackets to allow the bushing to radially expand and contract.

[0006] An advantage of the present invention is to provide for inner and outer load bearings formed by convolutions to define reservoirs for a lubricant to help reduce friction between the upper and lower jackets, wherein the convolutions are elastically deformed to adapt to the annual clearance between the upper and lower jackets.

[0007] Another advantage of the present invention is to provide for an economical and positive improving of the telescoping effect. Still another advantage of the present invention is to provide for the linear bushing to function as spring elements to radially expand and contract in different modes of operation of the telescoping steering column assembly.

[0008] Accordingly, the telescoping steering column assembly having the linear bushing of the present invention is new, efficient, and provides for the linear bushing formed with a number of end-wise convolutions that each function as spring elements as well as load bearing surfaces to support the telescoping tubes and lubricate the upper and lower jackets engaged within one another in the telescoping fashion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[00010] Figure 1 is an exploded perspective view of a telescoping steering column assembly having a linear bushing of the subject invention;

[00011] Figure 2 is a perspective view of the linear bushing;

[00012] Figure 3 is a perspective view of an alternative embodiment of the linear bushing shown in Figure 2;

[00013] Figure 4 is a cross sectional view of the telescoping steering column assembly having an upper jacket disposed in telescoping relationship within a lower jacket and the linear bushing disposed between the upper and lower jackets; and

[00014] Figure 5 is a cross section view similar to Figure 4 but showing the alternative embodiment of Figure 3.

DETAILED DESCRIPTION OF THE INVENTION

[00015] Referring to the Figures wherein like numerals indicate like or corresponding parts throughout the several views, a telescoping steering column assembly of the present invention, generally shown at **10** in Figure 1. The assembly **10** includes a lower mounting mechanism is generally indicated at **12**, for connecting to a

body, and connected to a lower jacket **14** having inner **16** and outer **18** surfaces. An upper jacket **20** having inner **22** and outer **24** surfaces is disposed in telescoping relationship with the lower jacket **14,** and an upper mounting mechanism for connecting to a vehicle body, is generally indicated at **26**, and slidably supports the upper jacket **20** for telescoping movement relative to the lower jacket **14** between various positions.

[00016] The telescoping steering column assembly **10** includes a linear bushing, generally shown at **28** in Figures 2 and 4, and at **128** in Figures 3 and 5, having leading **30**, **130** and trailing **32,132** ends and a side wall, generally indicated at **34**, **134**, disposed between the inner surface **22** of the upper jacket **20** and the outer surface **18** of the lower jacket **14.** The linear bushing **28**, **128** includes a plurality of convolutions disposed axially in side-by-side relationship as viewed in cross-section, as shown in figures 4 and 5, extending between the ends **30**, **130** and **32**, **132** of the linear bushing **28**, **128** to provide outer load bearing surfaces, generally indicated at **36**, **136** to engage the inner surface **22** of the upper jacket **20** and to provide inner load bearing surfaces, generally indicated at **38**, **138** to engage the outer surface **18** of the lower jacket **14**. The bushing **28**, **128** also includes radial walls **40, 140** for flexing to maintain the bearing surfaces **36**, **136** and **38**, **138** in engagement with the jackets **14**, **20** to allow the bushing **28**, **128** to radially expand and contract.

[00017] Referring back to Figure 1, the lower mounting mechanism **12** includes a lower bracket **42** of a generally rectangular configuration having an aperture **44** defined therewithin and a plurality of teeth **46** integral with and extending radially and outwardly from the lower bracket **42** to the aperture **44.** The lower jacket **14** includes a generally tubular configuration and has leading **48** and trailing **50** ends a pair of waste portions **52** defined at the trailing end **50** to engage mechanically within the teeth **46** of the lower bracket **42.** The upper jacket **20** includes a generally tubular configuration and has leading **54** and trailing **56** ends, wherein the upper jacket **20** is disposed in telescoping relationship with the lower jacket **14.**

[00018] The upper mounting mechanism **26** of the telescoping steering column assembly **10** is designed to slidably support the upper jacket **20** for telescoping movement relative to the lower jacket **14** between various positions. The upper mounting mechanism **26** includes an upper bracket **58** having first **60** and second **62** ends, a bottom **64**, and sides **66**, **68** extending upwardly from the bottom **64** to define a gap therebetween. The upper bracket **58** includes a slot **70** defined within each of the sides **66**, **68** at the first end **60.**

[00019] Referring to Figures 2 through 5, the radial walls **40, 140** of the linear bushing **28, 128** converge toward one another from the outer **36, 136** and inner **38, 138** load bearing surfaces to define an opening opposite each load bearing surface as viewed in cross-section. The linear bushing **28, 128** includes a plurality of arcuate corners **72, 172** interconnecting the radial walls **40, 140** and the outer **36, 136** and inner **38, 138** load bearing surfaces as viewed in cross-section. In the embodiment of Figures 2 and 4, each of the inner load bearing surfaces **38** extends circumferentially a shorter distance than each of the outer load bearing surfaces **36** extends circumferentially. In the embodiment of Figures 3 and 5, each of the inner load bearing surfaces **136** extends circumferentially a longer distance than each of the outer load bearing surfaces **138** extends circumferentially.

[00020] Referring back to Figures 4 and 5, the linear bushing **28, 128** includes a lubricant **L** stored in the plurality of convolutions to dispose the lubricant **L** over the inner surface **22** of the upper jacket **20** and the outer surface **18** of the lower jacket **12** to help reduce friction between the lower **14** and upper **20** jackets. The linear bushing **28, 128** is formed by a plastic extrusion process to allow a variety of convolution shapes with the number of convolutions to meet the needs of the telescoping steering column assembly **10.** The convolutions providing the outer **36, 136** and inner **38, 138** load bearing surfaces elastically deform radially to adapt the annular clearance between the lower **14** and upper **20** jackets. This deformation results in a zero clearance fit between the lower **14** and upper **20** jackets disposed in the telescoping relationship, and also results in an overlapping joint that is very stiff to resist bending.

[00021] The linear bushing **28, 128** may be manufactured in a form of a wrapped spring steel part or as a rolled convoluted tube. As appreciated by those skilled in the art, the linear bushing **28, 128** may be formed by an aluminum extrusion, or any other material or forming process to generate the convoluted shape with the proper springing effect. In addition, the lower **14** and upper **20** jackets, formed from metal, are coated with anti-friction material such as Teflon to promote lubricity. Furthermore, the linear bushing **28, 128** may be formed with a textured surface of a fine dimpled condition to retain other lubricants **L** such as grease, and the like.

[00022] Referring back to Figure 1, the telescoping steering column assembly **10** includes a compression bracket **80** having a bottom **82** and side walls **84, 86** and first **88** and second **90** ends and an inlet **92** defined within the side walls **84, 86** and extending between the first **88** and second **90** ends of the compression bracket **80**

perpendicularly to the slots **70** of the upper bracket **58.** The compression bracket **80** is slidably disposed within the upper bracket **58.** The telescoping steering column assembly **10** includes a release lever **94** having a shoulder **96** at one terminal end and a plate **98** at another terminal end. The shoulder **96** includes an inner surface **100** and a rod **102** extending outwardly therefrom to a distal end **104** having a male thread **106.** In operation, the release lever **94,** pushed upwardly or downwardly in different mode of operation controls the movement of the compression bracket **80** within the upper bracket **58.**

[00023] The telescoping steering column assembly **10** includes an adjustment cam **108** of a generally circular configuration having upper **110** and lower **112** surfaces and a hole **114** defined in a center of the adjustment cam **108.** The upper surface **110** of the adjustment cam **108** has a rake configuration **116** and a protrusion **118** extending outwardly from the lower surface **112.** The rod **102** extends through the hole **114** of the adjustment cam **108** and further through the slots **70** of the upper bracket **58** and the inlets **92** of the compression bracket **80** and secured by a flange nut **120.** The telescoping steering column assembly **10** includes a shaft **122** extending linearly and transversely through the upper **20** and lower **14** jackets.

[00024] Obviously, many modifications and variations of the present invention are possible in light of the above teachings. The invention may be practiced otherwise than as specifically described within the scope of the appended claims. These antecedent recitations should be interpreted to cover any combination in which the incentive novelty exercises its utility.